TABLE 14

Index i(cyclic shift)	Cyclic Shift Field in DCI format 0 [3]	$n_{DMRS}^{(2)}$	Cyclic shift value of RS for rank-1 index	Cyclic shift value of RS for rank-2 index	Cyclic shift value of RS for rank-3 index	Cyclic shift value of RS for rank-4 index
0	000	0	0	6	3	9
1	001	6	6	0	9	3
2	010	3	3	9	6	0
3	011	4	4	10	7	1
4	100	2	2	8	5	11
5	101	8	8	1	11	4
6	110	10	10	4	1	7
7	111	9	9	3	0	6

[0151] Table 15 shows an example of applying the OCC to the reference signal of the 3' and 4' layers of Table 14.

TABLE 15

Index i(cyclic shift)	Cyclic Shift Field in DCI format 0 [3]	$n_{DMRS}^{(2)}$	Cyclic shift value of RS for rank-1 index	Cyclic shift value of RS for rank-2 index	Cyclic shift value of RS for rank-3 index	Cyclic shift value of RS for rank-4 index
0	000	0	0	6	-3	-9
1	001	6	6	0	-9	-3
2	010	3	3	9	-6	-0
3	011	4	4	10	-7	-1
4	100	2	2	8	-5	-11
5	101	8	8	1	-11	-4
6	110	10	10	4	-1	-7
7	111	9	9	3	-0	-6

[0152] Table 16 shows an example of applying the OCC to the reference signal of the 1" layer of Table 14.

TABLE 16

Index i(cyclic shift)	Cyclic Shift Field in DCI format 0 [3]	$n_{DMRS}^{(2)}$	Cyclic shift value of RS for rank-1 index	Cyclic shift value of RS for rank-2 index	Cyclic shift value of RS for rank-3 index	Cyclic shift value of RS for rank-4 index
0	000	0	0	6	-3	-9
1	001	6	-6	-0	9	3
2	010	3	3	9	-6	-0
3	011	4	-4	-10	7	1
4	100	2	-2	-8	5	11
5	101	8	8	1	-11	-4
6	110	10	10	4	-1	-7
7	111	9	-9	-3	0	6

[0153] When the number of layers is less than or equal to 4, only cyclic shift values of reference signals of some layers may be allocated among the cyclic shift values of Table 13 to Table 16.

[0154] FIG. 13 is a block diagram showing an embodiment of the proposed reference signal transmission method.

[0155] In step S100, a UE generates a plurality of reference signal sequences in which different cyclic shift values are allocated respectively to a plurality of layers. In step S110, the UE generates an SC-FDMA symbol to which the plurality of reference signal sequences are mapped. In step S120, the UE transmits the SC-FDMA symbol through a plurality of antennas. The cyclic shift values allocated to the respective layers can be determined based on a 1st cyclic shift value which is a cyclic shift value allocated to a 1st layer among the plurality of layers and different cyclic shift offsets allocated to the respective layers.

[0156] FIG. 14 is a block diagram of a UE according to an embodiment of the present invention.

[0157] A UE 900 includes a reference signal generator 910, an SC-FDMA symbol generator 920, and a radio frequency (RF) unit 930. The reference signal generator 910 generates a plurality of reference signal sequences in which different cyclic shift values are allocated respectively to a plurality of layers. The SC-FDMA symbol generator 920 is connected to the reference signal generator and generates an SC-FDMA symbol to which the plurality of reference signal sequences are mapped. The RF unit 930 is connected to the SC-FDMA symbol generator and transmits the SC-FDMA symbol to a BS through a plurality of antennas.

[0158] The exemplary embodiments of the present invention may be implemented by hardware, software, or a combination thereof. The hardware may be implemented by an application specific integrated circuit (ASIC), digital signal processing (DSP), a programmable logic device (PLD), a field programmable gate array (FPGA), a processor, a controller, a microprocessor, other electronic units, or a combination thereof, all of which are designed so as to perform the above-mentioned functions. The software may be implemented by a module performing the above-mentioned functions. The software may be stored in a memory unit and may be executed by a processor. The memory unit or a processor may adopt various units well-known to those skilled in the art.

[0159] In the above-mentioned exemplary embodiments, the methods are described based on the series of steps or the flow charts shown by a block, but the exemplary embodiments of the present invention are not limited to the order of the steps and any steps may be performed in order different from the above-mentioned steps or simultaneously. In addition, a person skilled in the art to which the present invention pertains may understand that steps shown in the flow chart are not exclusive and thus, may include other steps or one or more step of the flow chart may be deleted without affecting the scope of the present invention.

[0160] The above-mentioned embodiments include examples of various aspects. Although all possible combinations showing various aspects are not described, it may be appreciated by those skilled in the art that other combinations may be made. Therefore, the present invention should be construed as including all other substitutions, alterations and modifications belonging to the following claims.

What is claimed is:

1. A method for transmitting a demodulation reference signal (DMRS) for a physical uplink shared channel (PUSCH), by a user equipment (UE), in a wireless communication system, the method comprising:

generating first, second, and third DMRS sequences, which are associated with first, second, and third layers respectively, by applying first, second, and third cyclic shifts to the first, second, and third DMRS sequences respectively; and

transmitting the first, second, and third DMRS sequences to a base station,